

**Spatial connectivity of Pacific insular species: Insights  
from modeling and tagging**

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2008**

**A thesis submitted for the degree of Doctor of Philosophy  
Department of Environmental Sciences  
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## **Certificate of Authorship**

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree.

I also certify that this thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

A handwritten signature in black ink, reading "Donald Klysi". The signature is written in a cursive style with a horizontal line underneath it.

Signature of candidate

## Acknowledgements

I would like to gratefully acknowledge the assistance, guidance, and continued friendship of my thesis supervisor, Dr. David Booth, over the course of my studies at UTS. Fruitful discussions with Dr. David Booth, Dr. Will Figueira, Dr. Jeffrey Polovina, Dr. Michael Seki, Dr. Samuel Pooley, Evan Howell, Dr. Milani Chaloupka, Dr. Jeffrey Leis, Dr. Ed DeMartini, Dr. John Randall, Bruce Mundy, George Balazs, Denise Parker, Kurt Kawamoto, Francis Oishi, Dr. Hidetada Kiyofuji, Stacy Kubis, Dr. John Wang, Dr. Dave Johnston and countless others have helped me in developing portions of my thesis work. Dr. James Potemra of the International Pacific Research Center, School of Ocean and Earth Science and Technology, University of Hawaii, capably assisted with the acquisition of the NLOM data. Evan Howell capably assisted with a variety of remotely-sensed data products used in this thesis. Although as with most things, any and all errors, misinterpretations, or oversights contained herein remain solely the responsibility of the author.

The assessors for my thesis, Dr. Claire Paris-Limouzy, Dr. Graeme Hays, and Dr. Geoffrey Jones contributed numerous valuable comments which helped improve this final version. I am also indebted to a NMFS Center for Independent Experts Review Panel comprised of Dr. Robert Cowen and Dr. Kenneth Frank, who also scrutinized much of the works contained here and offered valuable comments.

I give my most appreciative thanks to the UTS administrative staff at the Department of Environmental Sciences, the Faculty of Science, and the University Graduate School, particularly the very helpful assistance of Rochelle Seneviratne and Anita Anderson. Without the financial support of the International Postgraduate Research Scholarship, this thesis would not have been possible. The IPRS term extensions were most appreciated. The financial aspects of my candidature was a serious obstacle initially, and my IPRS was a dearly coveted item in my quest for an advanced degree.

I also give sincere thanks to my employment supervisor at the Pacific Islands Fisheries Science Center (PIFSC), National Marine Fisheries Service in Honolulu, Dr. Jeffrey Polovina, Division Chief of the Ecosystems and Oceanography Division, for patiently supporting and assisting my dissertation work at UTS. Dr. Michael Seki and Dr. Samuel Pooley of the PIFSC also provided invaluable support for my continued education. I thank one of my PIFSC co-workers, Robert Humphreys, for an insightful conversation over lunch in May of 2003 where I learned of the whereabouts of my long-lost HIMB colleague Dr. David Booth, which subsequently inspired me to investigate the feasibility of a Hawaii research project thesis at UTS.

For the opakapaka tagging work, I am deeply indebted to Mr. Richard Saito, Captain of the F/V Venus, for allowing the DAR research team the opportunity to tag and release opakapaka, which would not have been possible without his fishing talent and closely guarded secrets. Also a special thank you is provided to the many fishermen and fish markets who responded to requests for cooperation and assistance to make the study possible.

For the loggerhead turtle tagging study, I thank Masanori Kurita, Tomomi Saito, Hitoshi Nakamura, Miya Fisheries High School, Aichi Prefecture and Captains and

crews of the fishery training ship, *Aichi Maru*, Kyoshige Kobayashi, Taiheiyo Ferry Company and Captains and crews of the cargo passenger liners, *Kitakami* and *Ishikari*, Sea Turtle Association of Japan, Futoshi Iwamoto, Yuka Takeuchi, Yoshitaka Miyagata, Yaru Cai, Shou-Chin Kou, Chilang Fong, Ho-Chang Chen, Chao-Wei Kuo, Jen-Wei Sha, Yi-Shen Chen, Yu-Hou Duan, Jeu-Lin Chen, Po-Yen Hung, Bo-Zong Ke, Chunichi Newspapers, Kiyoshi Iwasa of Oceans Excursions, the passenger liner *Nippon Maru*, Marc Rice and students of the Hawaii Preparatory Academy, Wallace J. Nichols, Hoyt Peckham and The Grupo Tortuguero of Baja California, Kitty Simonds and WPRFMC staff, Pacific Island Regional Office Observer program and fishery observers, and Hawaii Longline Association for their invaluable assistance in the laboratory, field, office, and other generous support during this project.

Lastly and most importantly, I thank my family for their continued support during the past few years. My wife, Kim Kobayashi, children, Bryan Kobayashi, Kelli Ann Kobayashi, and Cody Kobayashi endured the often stressful times associated with advanced degrees, and my most appreciative thanks go to them all for their patience and understanding. I thank my parents, Eddie Kobayashi and Taeko Kobayashi, my sister and brother-in-law, Cindy Ingmanson and Lance Ingmanson, for continuing to encourage me to attain this goal. I also thank the members of the online gaming community ‘Renegade Heroes’ for their friendship, support, and providing a forum for my many complaints.

I dedicate this work to my parents: my mother, Taeko Kobayashi, and my late father, Eddie Kobayashi, who both always kept encouraging me to obtain my Ph.D, no matter how old and settled I became, or how grouchy I became at hearing the same question over and over...

To all, *mahalo nui loa*

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## **Abstract**

Animal movement was quantitatively investigated with computer simulation modeling and the analysis of animal-borne tagging data. Larval transport was simulated using advection-diffusion models driven by a variety of current fields. Seasonal, interannual, and spatial correlates of larval transport and retention were explored, as well as the effect of pelagic larval duration (PLD), using generalized additive modeling (GAM) analyses. Diel vertical migration (DVM) was simulated using layered current fields, and the effect on horizontal transport was examined over a range of PLDs, spawning locations, and spawning times. DVM was found to robustly facilitate natal retention in the simulations, using GAM analyses. Biogeographic transport routes linking Johnston Atoll and the Hawaiian Archipelago were elucidated using high-resolution current data and advection-diffusion models. The hypothesized transport routes were consistent with existing field survey data and genetic analyses. This connectivity has implications for both population maintenance and biogeographic affinities. Archipelagic connectivity was determined for all pairs of geographic strata in the region, and a simple metapopulation model was developed which was driven by the modeled linkages. Additionally, the flow fields used for the Johnston Atoll analysis and the archipelagic connectivity analysis were ground truthed with a drifter buoy database and found to be in good agreement. Conventional tags deployed on a deepwater snapper were examined to determine adult movement dynamics. Comparison to a simple model of swimming behavior suggested that biphasic swimming may be the characteristic swimming pattern for this species. Electronic tags deployed on sea turtles were used to characterize pelagic habitat in the North Pacific, using a suite of oceanographic and environmental data merged to the satellite tracks. Most of the analyses involved examination of a variety of remotely-sensed, modeled, or surveyed environmental data.